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FIG. 4c illustrates the superposition of the antenna feed pins and the director pins on the antenna feed system in accordance with an embodiment of the present invention.

FIG. 5 illustrates a microwave system comprising a center feed parabolic reflector incorporating antenna feed system, wherein an Ethernet cable provides the digital signal and power to the radio transceiver.

FIG. 6 illustrates a microwave system comprising a center feed parabolic reflector incorporating antenna feed system, wherein a USB cable provides the digital signal and power to the radio transceiver.

#### DETAILED DESCRIPTION

Although described in the context of an IEEE 802.11 Wi-Fi microwave system, the systems disclosed herein may be generally applied to any mobile network.

An exemplary embodiment of the present invention is based upon parabolic reflectors, which are well known in the industry. A parabolic reflector is a parabola-shaped reflective device, used to collect or distribute energy such as radio waves. The parabolic reflector functions due to the geometric properties of the paraboloid shape: if the angle of incidence to the inner surface of the collector equals the angle of reflection, then any incoming ray that is parallel to the axis of the dish will be reflected to a central point, or "locus". Because many types of energy can be reflected in this way, parabolic reflectors can be used to collect and concentrate energy entering the reflector at a particular angle. Similarly, energy radiating from the "focus" to the dish can be transmitted outward in a beam that is parallel to the axis of the dish. These concepts are well-known by one skilled in the art.

Definitions for this detailed description are as follows:

Antenna feed—An assembly that comprises the elements of an antenna feed mechanism, an antenna feed conductor, and a associated connector.

Antenna feed system—A system comprising an antenna feed and a radio transceiver.

Antenna system—A classical antenna system comprises the antenna feed and an antenna, such as parabolic reflector **101**. In the present invention, a radio transceiver is integrated with the antenna feed, so the antenna system comprises an antenna feed system and an antenna.

Center fed parabolic reflector—a parabolic reflector, and an antenna feed, wherein the signal to the antenna feed is "feed" through the center of the parabolic antenna.

Microwave system—A system comprising an antenna system, a radio transceiver, and one or more client station devices. The radio transceiver may be integrated with the antenna system.

FIG. 1 is a diagram of a prior art design **100** of the microwave system and a client station. The system consists of a parabolic reflector **101**, which is supported by a mounting bracket **102**. The parabolic reflector **101** reflects a RF signal **103** that is emitted from the antenna feed mechanism **104**. The antenna feed mechanism **104** receives the RF signal via the antenna feed conductor **105**. As illustrated in FIG. 1, the antenna feed conductor **105** is coupled to an RF connector **106**. In turn, the RF connector **106** is coupled to a coaxial cable or equivalent **107**. The coaxial cable **107** has a RF connector **106** on each end of the cable.

The other end of the coaxial cable **107** connects to the radio transceiver **108**, which is located in a weatherproof housing, **109**. This weatherproof housing **109** may be a housing just for the radio transceiver **108**, as illustrated in FIG. 1. Alternative, the weather proof housing **109** may be a housing suitable to

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enclose several electronic devices, including client station **114**. This latter configuration is not shown.

The radio transceiver **108** converts the RF signal to a baseband signal, based upon the modulation/demodulation algorithms implemented in the radio transceiver **108**. For example, the radio transceiver may implement a IEEE 802.11 transceiver. In this conversion, the baseband signal is encoded in the modulation process and becomes a non-baseband signal. Conversely, the non-baseband signal is decoded in the demodulation process and becomes a baseband signal. As noted above, the radio transceiver **108** supports radio frequency (RF) signals, but other embodiments of the radio transceiver **108** may support other types of non-baseband signals such as light or sound.

The radio transceiver **108** has a digital connector **110** that provides the input/output connectivity for a digital signal. The digital connector **110** may be, but is not limited to, an Ethernet connector or a USB connector.

As illustrated in FIG. 1, for one embodiment, a digital cable **111** is an Ethernet cable that connects from the radio transceiver **108** to a power over Ethernet (POE) device **112**. The POE device **112** injects power on the digital cable **111**, such that digital cable **111** supplies power to the radio transceiver **108**. The POE **112** receives power from an AC power source **113**. The digital signal is coupled on digital cable **115** from POE **112** to a client station **114**. The client station **114** may be a client computer such as a laptop.

There are a number of issues to be addressed in an improved performance and reduced cost microwave system.

First, as illustrated in the prior art microwave system and client station of FIG. 1, the RF transceiver **108** is located a distance from the antenna feed conductor **105**. As a minimum, a RF cable **107** and four RF connectors **106** are required. For longer distances a RE bi-directional amplifier is also required. Thus, there would be considerable benefits if the radio transceiver **108** was located near the antenna feed mechanism **104** or ideally physically integrated with the antenna feed mechanism **104**.

Second, a basic antenna feed system has a number of design and selection considerations. In FIG. 1, the antenna feed system includes the antenna feed conductor **105**, including an RF connector **106**, plus the antenna feed mechanism **104**. In the fundamental design, an antenna feed system is placed with its phase center at the focus of the parabola. Ideally, all of the energy radiated by the antenna feed will be intercepted by the parabola and reflected in the desired direction. To achieve the maximum gain, this energy would be distributed such that the field distribution over the aperture is uniform. Because the antenna feed is relatively small, however, such control over the feed radiation is unattainable in practice. Some of the energy actually misses the reflecting area and is lost; this is commonly referred to as "spillover". Also, the field is generally not uniform over the aperture, but is tapered, wherein the maximum signal at the center of the reflector, and less signal at the edges. This "taper loss" reduces gain, but the filed taper provides reduced side-lobes levels.

Third, one of the simplest antenna feeds for a microwave system is the dipole. Due to its simplicity, the dipole was the first to be used as a feed for reflector antennas. While easy to design and implement, the dipole feed has inherently unequal E and H plane radiation patterns, which do not illuminate the dish effectively and thus reduces efficiency. Another disadvantage of the dipole antenna feed for some applications is that due to unequal radiation patterns, cross polarization performance is not optimal. Accordingly, modification to a